Interactive Graphical Simulations For Experimental Physics Learning

J. M. Vargas[(1)], I. Alados[(1)], M. Peula[(1)] , E. Liger[(1)]

[(1)] Applied Physics Department II,ETSI Telecomunicación, University of Malaga.
(+34)952132889, jvd@uma.es

1. **Introduction** – In an effort to develop interactive tools for educational purpose in the field of Applied Physics [1], [2], a new interactive graphical simulation tool [3] is presented.

2. **Description** The electrostatic charges simulator (Image 1) allows users to position an arbitrary number of electric charges with their associated values (in nC). It displays the electrostatic field lines created by the electric charges, and shows the real time evolution of the field whenever the user moves around any of them. The number of electric field lines drawn coming out from the positive charges or getting in the negative charges is proportional to the absolute value of the charge, in nC, helping to graphically relate the concept of proportionality between the "electrostatic flow" and the number of field lines that cross a closed surface (cf. the Gauss law). The application of these concepts is illustrated in the second row of Image 2

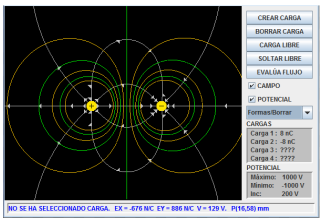

Image 1. The main panel of the graphical tool

Finally, the simulator lets the user positioning a small free charge in order to observe the evolution of his trajectory under the influence of the already established electric field. The fourth row of Figure 1 illustrates this option for the case of two values charges + *Q* and *-2Q*. It can be seen that by varying the initial position of the small free charge different trajectories of varied complexity are obtained (red lines in Image 2, third row)

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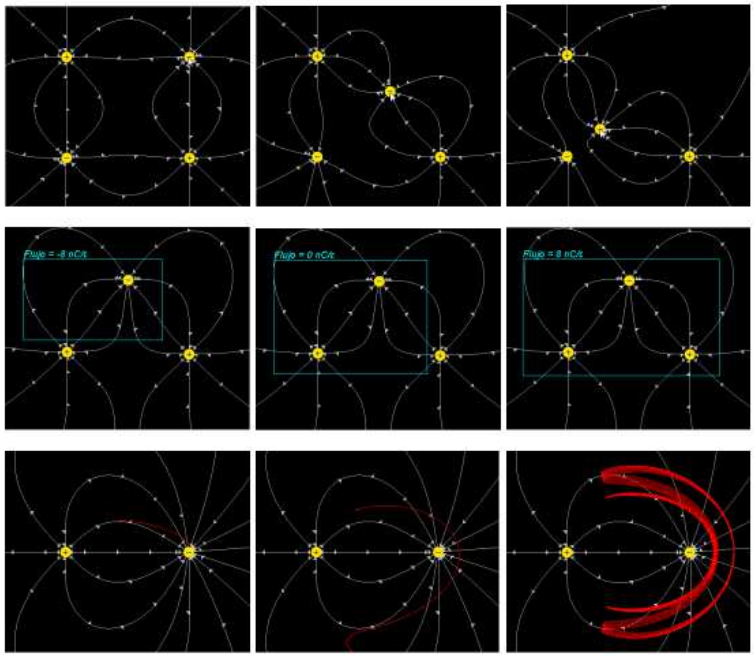

Image 2

4. Conclusions In general terms, the use of this type of interactive graphical simulations is a positive experience for both students and educators, that we strongly recommended

5. References

[1]I. Alados, E.Liger, J.M. Peula, J.M. Vargas y A. Fernández, XXXIII Reunión Bienal de la Real Sociedad Española de Física y 21º Encuentro Ibérico para la Enseñanza de la Física (2011).
[2]I. Alados, E.Liger, J.M. Vargas, F.J. Jiménez y J.M. Peula, XXXIV Reunión Bienal de la Real Sociedad Española de Física y 23º Encuentro Ibérico para la Enseñanza de la Física (2013).
[3] F. Pena, J.M. Vargas. Desarrollo de una aplicación Java para el aprendizaje de fenómenos electrostáticos. *PFC, Universidad de Málaga,* (2006).